Preliminary Results from the North Dakota Intensification of the National Wetland Condition Assessment

Shawn DeKeyser, Lindsey Meyers, Christina Hargiss, and Mike Ell

North Dakota State University, North Dakota Department of Health

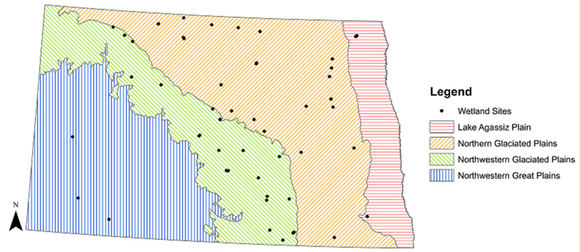
ABSTRACT

An intensification of the Environmental Protection Agency's (EPA) National Wetland Condition Assessment (NWCA) is being accomplished in North Dakota. Besides gathering the data needed for the NWCA the intensification included increasing North Dakota's overall sample size; comparing the NWCA techniques with regionally developed assessment techniques; modeling Carbon (C), Nitrogen (N), and Phosphorus (P) cycling under different wetland conditions; and sample for Mercury (Hg) content at each site. Based upon EPA recommendations, the original probabilistic sample size of 11 was increased to a total of 53 randomly selected wetland points located throughout North Dakota to meet sample size adequacy not only for the state but the wetland rich Prairie Pothole Region as well. The NWCA protocol for the characterization of a wetland point was completed at each site, and the three tiered assessment methods developed in North Dakota for the characterization of a wetland area were also completed for comparison. The protocol utilized during the 2011 field season ended up providing detailed plant species composition data, water quality samples, soil profile descriptions, soil chemistry samples, rapid assessment method data, buffer condition data, landscape variables data, hydrology data, and land-use/stressor data. Additionally, above ground plant biomass and soil samples were collected at different landscape positions (upland and wetland) at each site to be tested for C, N, and P content, for utilization in modeling the cycles of these elements in various wetland conditions. Samples were also collected at the different landscape positions to analyze for Hg content. The probabilistic approach utilized in the NWCA happened upon number of different types of North Dakota wetlands which included depressional, riparian, slope, and lacustrine that were found in both prairie and wooded environments. These wetlands were found under varying types and levels of land disturbance found within the wetland or its catchment which included cropping, grazing (native prairie and pasture), haying, Conservation Reserve Program, and idle. The preliminary results of these sites indicate a diversity of wetland conditions, both physically and biologically, representing the majority of North Dakota's ecoregions.

INTRODUCTION

- Land use has affected wetlands
  - -- Historically, the PPR was comprised of mixed and tall-grass prairie with about 20 to 60 % of the landscape containing wetland ecosystems (Seabloom and van der Valk 2003)
  - -- Cropping, draining, and natural climatic fluctuations have decreased the amount of wetlands across the state
- Wetland assessments:
  - -- Provide information on the current condition of the wetland
  - -- Identify major stressors
  - -- Are tools for monitoring wetland condition over time
- Wetlands provide many ecosystem services including nutrient storage and cycling
  - -- Freshwater aquatic systems can be greatly affected by nutrient runoff from adjacent lands (Cooper 1993)
  - -- The amount and type of nutrients stored in wetlands can affect the overall biological community and functioning of the wetland
  - -- What types of nutrients, and the bioavailability of these nutrients, can depend upon:
    - ~ type and distribution of plant and animal species
    - ~ nutrient input/output
    - ~ soil physical and chemical properties
    - ~ nutrient composition
    - ~ pH

MATERIALS & METHODS



At each of the 53 sites, four wetland assessments and various soil and plant samples were collected.

Assessments:

- National Wetland Condition Assessment (NWCA)
- Index of Plant Community Integrity (IPCI)
- North Dakota Rapid Assessment (NDRAM)
- Hydrogeomorphic (HGM) Model

Other samples:

- Plant for phosphorus (P), nitrogen (N), and carbon (C) analysis
- Soil for P and mercury (Hg) analysis

- NWCA methodology analyzes vegetation, soil, water quality, buffers, algae, and a rapid assessment (USEPA 2011)
- IPCI measures plant species cover and composition within each wetland zone using 1-m^2 quadrats (Kantrud and Newton 1996, DeKeyser et al. 2003, Hargiss et al. 2008)
- NDRAM rapidly assesses wetlands based on vegetation, land use, habitat alteration, and disturbance/stressors (Hargiss 2009)
- HGM Model is a functional assessment using measurements of landscape, hydrology, soil, and land use attributes to determine the extent of wetland alteration and function (Gilbert et al. 2006)
- Plant and soil samples were collected at three landscape positions: mid-slope, wet meadow zone, and shallow marsh zone
  - -- Five 0.25-m^2 quadrats of live vegetation were clipped and bagged at each landscape position for a total of 15 quadrats per site
  - -- Soil samples were collected at three locations per landscape position; two soil cores were extracted at each location for a total of 18 cores per site

PRELIMINARY RESULTS

Wetland assessment rankings for the IPCI and NDRAM

NDRAM	Temporary*	Seasonal	Semi-permanent**
Good	2	6	8
Fair High	0	5	12
Fair Low	2	6	7
Poor	0	6	1
Total	4	23	28

IPCI	Seasonal
Very good	4
Good	6
Fair	6
Poor	4
Very poor	3
Total	23

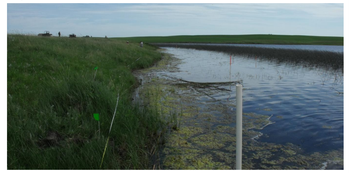
IPCI	Temporary*	Semi-permanent**
Good	2	8
Fair	2	9
Poor	0	11
Total	4	28

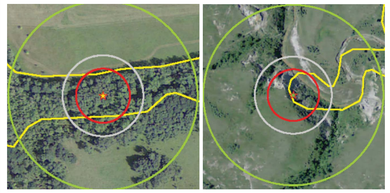
*2 are riparian, 1 is a fen

**2 are riparian, many are permanent and edges of shallow lakes

- Highly ranked wetlands (Very Good, Good) tend to be lightly grazed and sometimes left idle: they contain high plant species diversity
- Wetlands ranked in the middle (Fair High, Fair, Fair Low) are typically left idle or are in CRP lands: these wetlands may have once been cropped around and/or have invasive species such as hybrid cattail with Kentucky bluegrass, smooth bromegrass, and Canada thistle invading upland areas
- Low ranked wetlands (Poor, Very Poor) are usually cropped in upland areas and have low plant species diversity with many annual weeds and invasive species

Many wetlands sampled were actually part of permanent wetlands or shallow lakes; the assessment area only reflects a portion of the total wetland area for these water bodies.





Aerial photos of riparian wetlands. Most ND wetlands are not tree covered.

FUTURE ANALYSES

Data from this summer is currently being evaluated and lab analysis of plant and soil samples is being completed. Future statistical analyses include:

- Comparison of wetland assessment methods (NWCA, IPCI, NDRAM, HGM Model)
- Modeling of wetland assessment, land use, and/or nutrient pools
- Comparisons of how and where nutrients are stored in different wetlands using plant and soil data
- Analysis of ecosystem services in wetlands with special attention to wetland vegetation and nutrient cycling

Our data contains a wide variety of different wetland types in ND to be included in the analysis.

Comparisons of wetlands will be tested for level of disturbance such as farmed, restored, idle, and native (reference condition). Previous wetland data will be used in analyses.

REFERENCES

Cooper, C.M. 1993. Biological effects of agriculturally derived surface water pollutants on aquatic systems – a review. Journal of Environmental Quality 22: 402-408.

DeKeyser, E.S., D.R. Kirby, and M.J. Ell. 2003. An index of plant community integrity: development of the methodology for assessing prairie wetland plant communities. Ecological Indicators 3: 119-133.

Gilbert, M.C., P.M. Whited, E.J. Clairain, Jr., and R.D. Smith. 2006. A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes. US Army Corps of Engineers, Omaha, NE.

Hargiss, C.L.M., E.S. DeKeyser, D.R. Kirby, and M.J. Ell. 2008. Regional assessment of wetland plant communities using the index of plant community integrity. Ecological Indicators 8: 303-307.

Hargiss, C.L.M. 2009. Estimating wetland quality for the Missouri Coteau ecoregion in North Dakota. Ph.D. Dissertation. North Dakota State University, Fargo, ND.

Kantrud, H.A. and W.E. Newton. 1996. A test of vegetation-related indicators of wetland quality in the Prairie Pothole Region. Journal of Aquatic Ecosystem Health 5: 177-191.

Seabloom, E.W. and A.G. van der Valk. 2003. Plant diversity, composition and invasion of restored and natural prairie pothole wetlands: implications for restoration. Wetlands 23:1-12.

USEPA. 2011. National Wetland Condition Assessment: Field Operations Manual. EPA-843-R-10-001. U.S. Environmental Protection Agency, Washington, D.C.

ACKNOWLEDGEMENTS

Funding for this project provided by the ND Department of Health, EPA, and ND Water Resources Research Institute.

Thanks to our collaborators Jack Norland and Tom DeSutter. Thanks to ND Department of Health and NRCS for their help in the field taking water quality samples and identifying hydric soils. Also, thanks to many students: Matt Stasica, Jess Meissner, Patrick Corrigan, Eva Sebesta, and Levi Scheff for helping with this project.